



4-2-1

JCT

CT/PTO

30 MAR 2001

US

RT

Express Mail No.

FORM PTO-1390 (REV 10-95)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		3400P008	
		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/806727	
INTERNATIONAL APPLICATION NO. PCT/EP99/07137	INTERNATIONAL FILING DATE September 24, 1999	PRIORITY DATE CLAIMED October 2, 1998 and February 25, 1999	
TITLE OF INVENTION NTH ORDER FRACTAL NETWORK FOR HANDLING COMPLEX STRUCTURES			
APPLICANT(S) FOR DO/EO/US Gunter Schmidt; Maria Athelougou; Martin Baatz; Andrej Kharadi; Jurgan Klenk; Peter Blochl			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<ol style="list-style-type: none">1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.3. <input type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b)) and PCT articles 22 and 39(1).4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)).<ol style="list-style-type: none">a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).b. <input type="checkbox"/> has been transmitted by the International Bureau.c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).<ol style="list-style-type: none">a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).b. <input type="checkbox"/> have been transmitted by the International Bureau.c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.d. <input type="checkbox"/> have not been made and will not be made.8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).			
Items 11. to 16. below concern document(s) or information included:			
<ol style="list-style-type: none">11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.13. <input type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.14. <input type="checkbox"/> A subsequent specification.15. <input type="checkbox"/> A change of power of attorney and/or address letter.16. <input checked="" type="checkbox"/> Other items or information: priority request; formal drawings submittal; PCT request; IB 304, 306 (twice), 308; International Preliminary Examination Report including amended sheets; English translation of amended description and claims			

US

JC02 Rec'd PCT/PTO 30 MAR 2001

Annex US.II, page 2 PCT Applicant's Guide - Volume II - National Chapter - US

U.S. APPLICATION NO. 097/806727		INTERNATIONAL APPLICATION NO. PCT/EP99/07137		ATTORNEY'S DOCKET NUMBER 03400.P008	
--	--	--	--	---	--

17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482 nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by EPO or JPO \$1000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO. \$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$700.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				CALCULATIONS FOR PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).					
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	34 - 20 =	14	X \$18.00	\$ 252.00	
Independent claims	1 - 3 =	0	X \$78.00	\$ 0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$270.00				\$ 270.00	
TOTAL OF ABOVE CALCULATIONS =				\$ 1382.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				\$	
SUBTOTAL =				\$ 1382.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$ 1382.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				\$	
TOTAL FEES ENCLOSED =				\$ 1382.00	
				\$ Amount to be: refunded	\$
				charged	\$

a. ☒ A check in the amount of \$ 1382.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
 A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
 overpayment to Deposit Account No. 022666. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR
 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Blakely, Sokoloff, Taylor & Zafman LLP
 12400 Wilshire Blvd. 7th Floor
 Los Angeles, CA 90025-1026

SIGNATURE _____
 Eric S. Hyman
 NAME _____
 30,139
 REGISTRATION NUMBER _____

AMENDED DOCUMENTS

Description **n^{th} -Order Fractal Network for Handling Complex Structures**

5

The invention relates to an n^{th} -order fractal network for handling complex structures in accordance with the preamble of claim 1, and in particular to a fractal or fractal-hierarchical network having a multiplicity of
10 semantic units, whereby semantically structured information may be analyzed and treated.

Concurrently with a progressive transformation of the industrial society towards the information society, there
15 is an increasing need for a tool to process the growing flood of information. Particularly in the field of image recognition, speech recognition and simulation, comprehensive investigations were carried out to make possible a simplification in the recognition,
20 modification and utilization of complex structures such as, for example, speech and images.

The like systems in the prior art do, however, suffer from poor flexibility and extraordinarily complicated
25 provision and processing of the data or information used. The data to be processed are moreover essentially static.

Particularly in the case of dynamic complex structures or of chaotic technical systems, processing of
30 such data is extraordinarily difficult or even impossible.

In the prior art it is furthermore known to handle informational contents in a structured manner with the
35 aid of the data description language XML or extended Markup Language (derived from SGML, ISO8879), respectively. Structuring herein may be semantic.

AMENDED DOCUMENTS

"Semantic" here means that references of an informational content to other informational contents may carry a meaning. Herein it is possible to formulate meta-data, i.e., data describing data. In the data description language XML it is, however, not possible to store information about processes in a way that would enable this very information to enter into a data analysis and into an "intelligent" behavior of a semantic network.

The prior art currently employed in the field of knowledge about processes is reflected in methods and processes for pattern recognition and simulation. Even though currently employed methods are, as it were, quite mature, there is no knowledge whatsoever about objects within their semantic contexts. In a simple illustrative contemplation it may thus be said that a presently employed pattern recognition is, for example, not cognizant of the facts that "a coniferous wood in general is a wood" and that "bridges frequently span rivers".

A fractal network in accordance with the preamble of claim 1 is known from Ying-Kuei Yang: "BEHIND THE INHERITANCE RELATIONS IN A SEMANTIC NETWORK", Proceedings of the Southeast Conference (Southeastcon), US, New York, IEEE, 1990, pages 289 to 295, Lim E-P: "SEMANTIC NETWORKS AND ASSOCIATIVE DATABASES: TWO APPROACHES TO KNOWLEDGE REPRESENTATION AND REASONING", IEEE Expert, August 1992, Vol. 7, No. 4 pages 31 to 40, XP002129793, ISSN: 0885-9000 and Bingi et al.: "A FRAMEWORK FOR THE COMPARATIVE ANALYSIS AND EVALUATION OF KNOWLEDGE REPRESENTATION SCHEMES", Information Proceeding & Management (Incorporating Information Technology), GB, Pergamon Press Inc. Oxford, Vol. 31, No. 2, 1. March 1995, pages 233 to 247.

AMENDED DOCUMENTS

The present invention is based on the object of furnishing an n^{th} -order fractal network for handling complex structures which makes it possible to store information or knowledge in a structured form, and by means thereof analyze data and link them therewith.

This object of the present invention is attained through the features set forth in claim 1.

10 Further advantageous developments of the present invention are subject matters of the subclaims.[from original page 4]

15 More precisely, in accordance with the present invention a fractal network for handling complex structures is furnished which consists of a multiplicity of units. The fractal network contains both semantic units each possessing informational contents, and linking units describing a respective relational content. The
20 relational content links two respective semantic units in such a way that the mutual relation of the two linked semantic units is determined by the relational content. The network additionally contains specific semantic Janus units capable of carrying out specific operations on
25 other semantic units.

30 A central element herein is the semantic unit representing an "object" or a "process of the world" as a data structure. An essential feature of the semantic unit is the ability to store informational contents in a structured manner and to mesh or cross-link with other semantic units. In order for two semantic units to be linked in such a way that the combination will carry a meaning or will be semantic, these semantic units are
35 connected among each other through the specialized linking units. A like linking unit may, for example, also

AMENDED DOCUMENTS

be implicitly provided in a structured informational content of a semantic unit.

5 These linking units can be a particular form of semantic units which may possess informational contents and relational contents.

10 In order to be able to carry out non-ambiguous operations in the "world knowledge" present in the fractal network, an identification which is unique within this "world knowledge" may be allocated to each semantic unit.

15 There moreover exists a possibility of creating a data structure which makes it possible at any time to alter information or knowledge already existing in the fractal network and to add new parts. Due to the fact that the knowledge encompasses not only information about objects but also knowledge about information-processing
20 processes, it is possible to alter content and structure of the knowledge in a dynamic procedure.

25 Complex structures may represent speech, images, networks or chaotic systems such as, e.g., technical, cultural, economic or ecological contexts.

30 The present invention shall in the following be explained in more detail by way of embodiments while referring to the annexed drawing, wherein:

Figs. 1a to 1e show various types of linking units utilized in the embodiments of the present invention;

AMENDED DOCUMENTS

- Fig. 2 is a representation of an n^{th} -order fractal network in accordance with a first embodiment of the present invention;
- 5 Fig. 3 shows structured informational contents and relational contents in semantic units and linking units, respectively, in accordance with the first embodiment of the present invention;
- 10 Figs. 4a and 4b are representations of further fractal networks in accordance with the first embodiment of the present invention;
- 15 Fig. 5 shows structured informational contents in semantic units having attributes in accordance with the first embodiment of the present invention;
- 20 Fig. 6 is a representation of an n^{th} -order fractal network in accordance with the first [second] embodiment of the present invention;
- 25 Figs. 7a and 7b are representations of a semantic network in accordance with a second [third] embodiment of the present invention;
- 30 Figs. 8a and 8b are representations of a semantic network in accordance with a third [fourth] embodiment of the present invention; and

AMENDED DOCUMENTS

Figs. 9a to 9c are representations of a semantic network in accordance with a fourth [fifth] embodiment of the present invention.

5 The following is a description of embodiments of the present invention.

Before describing in detail the embodiments of the present invention, the following is to be noted.
10 Generally speaking, an n^{th} -order fractal network for handling complex structures is comprised of a multiplicity of units. The fractal network contains both semantic units each possessing informational contents, and linking units describing a relational content. The
15 relational content links two respective semantic units in such a way that the mutual relation of the two linked semantic units is determined by the relational content. The term "semantic" here is meant to denote "carrying meaning".
20

The like linking units may represent a particular form of semantic units which may possess informational contents and relational contents.

25 Apart from a combination of semantic units through linking units, there moreover is the possibility of one or several linking units in turn being linked through one or several respective linking units with one or several semantic units, and/or one or several linking units in
30 turn being linked through one or several linking units with one or several linking units, as will become evident from the following description.

Such relational contents of linking units may as a
35 general rule be selected freely by a user. It is, however, sensible to preliminarily define some elementary

AMENDED DOCUMENTS

relational contents of linking units in a basic library. Conceivable elementary relational contents of linking units are exchange relations and relations. Exchange relations are defined as those relations describing an abstract, material and/or communicative exchange between semantic units. Relations, on the other hand, are those relational contents of linking units which describe relations of some kind between semantic units.

Figures 1a to 1e show several such elementary linking units describing a respective relational content.

In the case of hierarchically structured knowledge, such as in the fractal network, linking units of the exchange relation type may be further subdivided into two groups.

What is shown in Fig. 1a is a linking unit 1 of the exchange relation type which interconnects semantic units in mutually different hierarchy planes of the n^{th} -order fractal network. What is thus described is the kind of relation of a larger, i.e., superordinate semantic unit with a smaller, i.e., subordinate semantic unit and vice versa. In other words, a scale change is carried out. Linking units having relations which exhibit the two named features, namely, an exchange and a scale change, are hereinafter designated as linking units of the VA/VS type. In the expression "VA/VS", the expression "VA" accordingly represents "exchange", and the expression "VS" represents "scale change". In simple terms, a like linking unit 1 of the VA/VS type may be regarded to be "A contains B" in the direction of the arrow from A to B shown in Fig. 1a, and "B is part of A" in the opposite direction. This corresponds to the definition of an embedding hierarchy.

AMENDED DOCUMENTS

Fig. 1b shows linking units 2, 2a and 2b of the exchange relation type which interconnect semantic units in same hierarchy planes of the n^{th} -order fractal network. In other words, no scale change is performed.

5 Linking units having relations which exhibit the two named features, namely, an exchange and no scale change, are hereinafter designated as linking units of the VA/VH type. In the expression "VA/VH", the expression "VA" correspondingly represents "exchange", and the expression

10 "VH" represents "no scale change". In simple terms, a like linking unit 2a of the VA/VH type may be regarded to be "A is input quantity of B" in the direction from A to B, and "B is output quantity of A" in the opposite direction, and such a linking unit 2b of the VA/VH type

15 may be regarded to be "A is described by B" in the direction from A to B, and "B is attribute of A" in the opposite direction.

In the case of hierarchically structured knowledge,

20 as in the fractal network, linking units of the relation type may also be further subdivided into two groups.

Fig. 1c shows a linking unit 3 of the relation type which interconnects semantic units in mutually different

25 hierarchy planes of the n^{th} -order fractal network. What is thus described is the kind of relation of a more general semantic unit with a more specific semantic unit and vice versa. In other words, a scale change is performed. Linking units having relations which exhibit

30 the two named characteristics, namely, a relation and a scale change, are hereinafter referred to as linking units of the VR/VS type. In the expression "VR/VS", the expression "VR" accordingly represents "relation", and the expression "VS" represents "scale change". In simple

35 terms, a like linking unit 1 of the VR/VS type may be regarded to be "A in particular is B" in the direction of

AMENDED DOCUMENTS

the arrow from A to B shown in Fig. 1c, and "B in general is A" in the opposite direction. This corresponds to the definition of a similarity hierarchy.

5 Fig. 1d shows linking units 4, 4a, 4b and 4c of the relation type which interconnect semantic units in same hierarchy planes of the n^{th} -order fractal network. In other words, no scale change is performed. Linking units having relations which exhibit the two named features, 10 namely, a relation and no scale change, are hereinafter referred to as linking units of the VR/VH type. In the expression "VR/VH", the expression "VR" accordingly represents "relation", and the expression "VH" represents "no scale change". In simple terms, a like linking unit 15 4a of the VR/VH type may be regarded to be "A is (locally) adjacent B", a like linking unit 4b of the VR/VH type may be regarded to be "A is similar to B", and a like linking unit 4c of the VR/VH type may be regarded to be "B follows after A" in the direction from A to B and "A is followed by B" in the opposite direction. 20

Fig. 1e moreover shows another linking unit 5 which may be regarded to be "A has Janus/function B" in the direction from A to B and "B is Janus/function of A" in 25 the opposite direction. For a more detailed description of this linking unit 5, reference is made to the description of the embodiments further below.

Finally it should be noted that evidently linking 30 units may both be directional, i.e., directed, and bidirectional, i.e., non-directional.

The following is the description of a first 35 embodiment of the present invention.

AMENDED DOCUMENTS

Fig. 2 shows a simple fractal network whereby the cooperation of above explained linking units with further semantic units present in the fractal network is illustrated.

5

In Fig. 2, reference symbol 3 designates a linking unit of the VR/VS type, reference symbol 4b designates a linking unit of the VR/VH type, and reference symbols 6 designate respective semantic units.

10

If, now, the phrase "man in general is mammal" is to be represented in the "world knowledge" existing in the form of a fractal network, then the semantic units 6 designated by "man" and "mammal" are linked with each other by the directional, i.e. directed, linking unit 3 of the VR/VS type, more precisely of the "is in general/is in particular" type. If moreover the statement is to be added that "simian and man share a 95% similarity in the context of gene analysis", the semantic unit 6 designated as "simian" is linked with the semantic unit 6 designated as "man" by a bidirectional linking unit 4b of the VR/VH type, more precisely of the type "is similar to". The linking unit 4b has in its informational content a weighting of 95%. Linking unit 4b is moreover linked with the semantic unit 6 designated as "gene analysis" through a linking unit (not previously explained) of the type "in the context".

Fig. 3 shows structured informational contents and relational contents of the semantic units and linking units shown in Fig. 2.

The upper part of Fig. 3 shows the informational contents of the respective semantic units of Fig. 2 which contain an identification, a name and identifications of the linking units connected with them. Thus the semantic

AMENDED DOCUMENTS

unit 6 designated as "man" in Fig. 2 has an identification "1" and the name "man" and is linked with linking units having identifications "12" and "13". The semantic unit 6 designated as "mammal" in Fig. 2 has an identification "2" and the name "mammal" and is linked with the linking unit having the identification "12". The semantic unit 6 designated as "simian" in Fig. 2 has an identification "3" and the name "simian" and is linked with the linking unit having the identification "13". The semantic unit 6 designated as "gene analysis" in Fig. 2, finally, has an identification "4" and the name "gene analysis" and is linked with a linking unit having the identification "134".

In the lower part of Fig. 3, the relational contents of the respective linking units of Fig. 2 are shown which contain an identification, a name, identifications of the linking units possibly connected with them, identifications of the semantic units or linking units linked by them, and the type of that combination. Thus the linking unit 3 shown in Fig. 2 has the identification "12" and the name "is in general"; it is not connected with any other linking unit and directionally links the semantic unit having identification "1" with the semantic unit having identification "2". The linking unit 4b shown in Fig. 2 has the identification "13" and the name "is similar to"; it is connected with the linking unit having identification "134" and bidirectionally links the semantic unit having identification "1" with the semantic unit having identification "3", wherein it contains a 95% weighting. The linking unit "in the context" shown in Fig. 2, finally, has the identification "134" and the name "in the context"; it directionally links the linking unit 13 with the semantic unit 4.

AMENDED DOCUMENTS

A graphic representation of the contexts shown in Fig. 3 accordingly results in the representation of the fractal network in Fig. 2.

5 In general it should be noted that the informational content described by a semantic unit represents a characterization and/or an enumeration of those linking units connecting this semantic unit with other semantic units, with the characterization preferably being a name
10 or a serial number, and the informational content preferably also being present in a structured form.

The linking units describe relational contents which, besides an informational content, also contain a linking
15 identification. This linking identification describes the respective characterization of the semantic units and/or linking units whereby they are linked, one or several indications of direction in relation to these linked semantic units and/or linking units, and/or weightings of
20 the one or two indications of direction.

As can be seen from the first embodiment, there is moreover the possibility of a linking unit being linked with a semantic unit through another linking unit.
25 Moreover the relational content of the linking unit may optionally contain information about the respective type of linking of the interrelated semantic units, with this type of linking optionally containing additional information about a relation, i.e., a comparison of the
30 respective linked units, and/or about an exchange relation, i.e., a uni- or bilateral interaction of the linked units, with the type of linking moreover containing additional information about whether or not a scale change takes place. In an exchange relation, this
35 information concerning a scale change may describe the type of relation with a larger, i.e. superordinate, or

AMENDED DOCUMENTS

smaller, i.e. subordinate, semantic unit or vice versa, or the type of relation with a more general semantic unit or a more specific one.

5 Figures 4a and 4b show further fractal networks in accordance with the first embodiment of the present invention, which serve to facilitate comprehension.

10 Fig. 4a shows a fractal network wherein a semantic unit 6 designated as "wood" is linked through a linking unit 3 of the VR/VS type, more precisely of the "is in general/is in particular" type, with a semantic unit 6 designated as "segment", wherein the linking unit 3 of the VR/VS type furthermore contains a weighting of 70% to
15 result in the statement "segment has a 70% wood classification". Here the linking unit of the VR/VS type may more accurately be designated as VR/VS(+), for evidently the result is a scale change towards a smaller scale from the semantic unit 6 designated as "wood" to
20 the semantic unit 6 designated as "segment", with the smaller scale in the present application example resulting from a smaller degree of indeterminacy in the attributes of "wood" and "segment" which are not described in any further detail. In the above example a
25 similarity hierarchy is formulated, so that in a case of indeterminate representation of knowledge of the weighting (here: 70%) in the informational content, the linking unit receives the function of a measure for the association to a corresponding class (here: "wood"). When
30 one now moreover regards the linking unit 1 of the VA/VS type, more precisely "consists of/is part of", then the statement "wood consists of trees" is created, implicitly expressing that a tree is substantially smaller than a wood and is thus situated on a lower or finer scale.

35

AMENDED DOCUMENTS

Fig. 4b shows a fractal network wherein a semantic unit 6 designated as "Peter" is linked through a linking unit 4 of the VR/VH type with a semantic unit 6 designated as "Paul". Moreover the linking unit 4 of the VR/VH type is linked through a linking unit 2b of the VA/VH type, more precisely of the type "is described by/is attribute of", with a semantic unit 6 designated as "friendship". Thus in the final outcome the statement "Peter and Paul are friends" is obtained inasmuch as the linking unit 2b, with the aid of the semantic unit 6 designated as "friendship", more closely describes an abstract exchange ("friendship").

Finally it should be noted that with the aid of linking units of the VR/VH type, i.e., relations without a scale change, associations and comparisons can be defined. Here it is frequently useful to interpret the weighting in the informational content of the linking unit as a measure for the similarity of the linked semantic units. Examples herefor are the statements, "man shares a 95% similarity with simian" and "winter is followed by spring".

Fig. 5 shows structured informational contents of semantic units with attributes in accordance with the first embodiment of the present invention.

Every semantic unit may file data and functions of any form in its informational content. In accordance with the first embodiment of the present invention, the name of the semantic unit and its identification have already been described. In addition, informational contents of the semantic units and/or linking units may, besides or instead of static data, also contain algorithms, functions and/or mathematical formulae.

AMENDED DOCUMENTS

Moreover there equally exists the possibility of semantic units containing informational contents which represent attributes, with these attributes more closely describing other semantic units or linking units (see, for example, the semantic unit 6 in Fig. 4b designated as "friendship"). The fractal network here includes specific linking units which have the function of accomplishing the combination of semantic units which represent attributes with those semantic and/or linking units to which these attributes are associated (see, for example, linking unit 2b in Fig. 4b). These particular linking units 2b are designated by "is described by/is attribute of".

These attributes may, for example, contain values which are elements from a set, a range, an list or some other ordered or inordinate structure. This ordered or inordinate structure may be formed by one or several figures, sectors in n-dimensional spaces, text data, image data, video data, audio data, calendar data, tables, geometry data, geographical data, fuzzy-logic sets, Internet contents or bundled data or a combination of these, so as to be able to advantageously store "world knowledge". One example for this is represented in Fig. 5, with a more detailed description of the figure being omitted on account of its self-descriptive character.

One essential feature of the first [second] embodiment of the present invention is the possibility of incorporating specific semantic units into the fractal network, which are capable of performing certain operations on other semantic units. These specific semantic units shall hereinafter be referred to as semantic Janus units.

35

AMENDED DOCUMENTS

In the present context, a semantic Janus unit 6 (see Fig. 6) designates a specific semantic unit presenting an algorithm or a collection of algorithms which can alter the informational content of semantic units and/or create
5 new semantic units or destroy existing semantic units, respectively. A semantic Janus unit is connected through a respective specific linking unit 5 (see Fig. 1e) of the type "has Janus/function/is Janus/function of" with one or several semantic units in whose vicinity the semantic
10 Janus unit is to operate.

This means that the functionality of the semantic Janus unit is limited to a degree of merely being capable of performing the particular operations on those semantic
15 units which are located in a predetermined vicinity range of a semantic unit linked therewith. Moreover a semantic Janus unit may be linked, through one or several linking units, with further semantic Janus units and/or with attributes.

In detail, a semantic Janus unit can perform one or several of the following operations: creating new semantic units; bundling already existing semantic units into a single semantic unit which possibly is to be newly
25 generated; altering and/or deleting already existing semantic units; comparing existing semantic units; recording and altering values of the attributes of semantic units; performing an algorithm and/or calculating a function; recording a Janus or part of a
30 Janus, i.e., classification of an algorithm or of part of an algorithm.

The essential task of a semantic Janus unit consists in bundling and contexting informational contents.
35 Bundling here is to be understood as the calculation of informational contents of a semantic unit serving as a

AMENDED DOCUMENTS

center from the informational contents of adjacent semantic units. Contexting is to be understood as the analogously inverse process for bundling, i.e., informational contents of the adjacent semantic units are altered in dependence on the informational contents of the semantic unit serving as a center, with the latter defining the vicinity. In this way it is, e.g., possible in a simple manner to constantly obtain up-to-date statistics of a set of semantic units (bundling), or to immediately pass on changes of basic conditions to a set of semantic units (contexting).

Fig. 6 represents an n^{th} -order fractal network which is used to enlarge on the explanations given above with respect to the second embodiment of the present invention.

The fractal network in Fig. 6 has the purpose of correctly averaging a current average income in dependence on respective basic conditions.

More precisely, Fig. 6 shows a semantic unit 6 designated as "law firm MM" linked, through one linking unit 1 of the VA/VS type each, with the semantic units 6 designated as "Mueller" or "Maier", respectively, whereby linkages of the type "law firm MM contains Mueller/Mueller is part of law firm MM" and "law firm MM contains Maier/Maier is part of law firm MM" are created. In this embodiment of the present invention, the semantic unit 6 designated as "law firm MM" is connected through a linking unit 5, namely a linking unit of the type "has Janus/function/is Janus/function of", with a semantic unit 6 designated as "bundle" which in this embodiment of the present invention accordingly acts as a semantic Janus unit with respect to the semantic unit 6 designated as "law firm MM". The function of input quantity of this

AMENDED DOCUMENTS

semantic Janus unit is fulfilled by the attribute type to be bundled, namely, in the case of the present embodiment the income made up of the individual incomes of the firm. The function of output quantity of the semantic Janus
5 unit is fulfilled by an attribute into which the average income is written. An essential advantage of this kind of statistic data resides in the fact that when an attorney is added to or removed from the firm, changes to the method for calculating the average income are not
10 necessary.

The following is a description of a second [third] embodiment of the present invention.

15 One essential advantage of the above described Janus unit is the fact that it only acts locally, within a defined vicinity. It is accordingly important to define the term "vicinity" more accurately, which is done in this second [third] embodiment of the present invention.
20

The term vicinity is closely related with the term distance. A first semantic unit is defined to be adjacent to a second semantic unit when a distance between them is smaller than a predetermined or calculated value, i.e., a
25 limit value. Herein a measure of the distance is dependent on informational and/or connotational contents of the semantic units through which the second semantic unit can be reached starting out from the first semantic unit.
30

For example it is possible to calculate the measure of the distance with weightings in linking units, with the type of linking unit also entering into this calculation.
35

AMENDED DOCUMENTS

Figures 7a and 7b show a simple example for such use of a distance measure in accordance with the second [third] embodiment of the present invention.

5 In accordance with the fractal network shown in Fig. 7a, the problem to be solved is to determine the vicinity of circle of friends of the semantic unit 6 designated as "Paul". This is accomplished by proceeding only via linking units 7 of the type "is friends with", wherein it
10 is assumed that the weighting of the linking units 7 of the type "is friends with" is indicated as a measure for friendship, and friends of friends are also counted as belonging to the circle of friends.

15 Weighting of the linking units 7 of the type "is friends with" may, for example, be transformed into a distance with the aid of a logarithmic function. Thus the distance between the semantic unit 6 designated as "Paul" and the semantic unit 6 designated as "Peter" is, for
20 example:

$$d(\text{Paul}, \text{Peter}) = -\log(0.8) = 0.10$$

25 If, now, a limit for a maximum distance of 0.2 is fixed in the semantic Janus unit 6 which is designated as "obtain circle of friends" and obtains the circle of friends of the semantic unit 6 designated as "Paul", the resulting circle of friends of the semantic unit 6 designated as "Paul" in this embodiment are the semantic
30 unit 6 designated as "Peter" and having a distance of 0.1, the semantic unit 6 designated as "Mary" and having a distance of 0.07, and the semantic unit 6 designated as "Jakob" and having a distance of 0.12. Not contained in the circle of friends, however, is the semantic unit 6
35 designated as "Anne" having a distance of 0.25.

AMENDED DOCUMENTS

Herein the distance of the semantic unit 6 designated as "Paul" from the semantic unit 6 designated as "Jakob" is calculated as follows:

5 $d(\text{Paul}, \text{Jakob}) = d(\text{Paul}, \text{Mary}) + d(\text{Mary}, \text{Jakob}) =$
 $-\log(0.85) - \log(0.9) = -\log(0.85 * 0.9) = 0.12$

10 The aforementioned calculation is analogously valid
for the distance of the semantic unit 6 designated as
"Paul" from the semantic unit 6 designated as "Anne".
More precisely, in order to determine the distance, the
respective weightings of linking units 7 of the type "is
friends with" are multiplied. Herein the circle of
friends may change without it being necessary to alter
15 the method for calculating the circle of friends.

 If, now, a semantic unit 6 designated as "Paul's
circle of friends" is to be formed which may, for
example, be returned as a response to the fractal network
20 as a result set of an inquiry, then it is necessary in
accordance with the representation of Fig. 7b to create
this semantic unit 6 designated as "Paul's circle of
friends" from the semantic Janus unit 6 designated as
"obtain circle of friends" and link it with the
25 corresponding semantic units 6 designated by names. Here
it should be noted that the semantic units 6 designated
by names, which are contained in the circle of friends,
namely, in accordance with the present embodiment the
semantic units 6 designated as "Paul", "Mary" and
30 "Jakob", are automatically linked through linking units 1
of the VA/VS type, more precisely of the type
"contains/is part of", with the semantic unit 6
designated as "Paul's circle of friends" as is
represented by dashed lines in Fig. 7b.

35

AMENDED DOCUMENTS

As was described above, in accordance with the present embodiment a distance function is employed to specify the distance between two respective semantic units. Although a particular mathematical function, i.e.,
5 the previously mentioned logarithmic function, was used in this embodiment for determining the distance from the weighting of linking units, it is noted that other suitable mathematical functions of a variable parameter G may be fixed as the distance function, with this
10 parameter G being present in each linking unit and expressing the strength of linking of respective semantic units.

The following is a description of a third [fourth]
15 embodiment of the present invention.

In order to provide for expansion of the knowledge existing in a fractal network, it is necessary to - preferably automatically - link new input data with
20 already existing knowledge. For this reason, the input data must be present in the form of semantic units, i.e., semantic input units must exist. The latter must furthermore possess an identification differentiating them from the semantic units of the knowledge already
25 present in the fractal network. By means of an iterative classification or identification process, linking units of the VR/VS or VR/VH type are generated between the semantic input units and the associated semantic units of the knowledge. Classification/identification here means
30 that the informational content of each input data is put into relation with one or several corresponding semantic units of the knowledge. Weighting of the relation is a measure for the association of the input units with the corresponding semantic unit of the knowledge.

35

AMENDED DOCUMENTS

Figures 8a and 8b show a classification/identification process of a phrase in a semantic network in accordance with the fourth embodiment of the present invention. More precisely, Fig. 8a shows a start situation and Fig. 8b shows a result situation.

The example used is the phrase, "*Der Schlüssel steckt im Schloß*" [The key is inserted in the lock]", the meaning of which cannot be deduced without background knowledge, for "*Schloß*" may be a locking mechanism [lock] on the one hand and a building [castle] on the other hand.

It is now the task of the semantic Janus unit 6 shown in Fig. 8a and designated as "classification Janus" to correctly link the semantic unit 6 designated as "*Schloß*" [lock; castle] on the left-hand side of this figure with the world knowledge present in the fractal network. This is accomplished, for example, by realizing through a syntactic preliminary analysis that the semantic units 6 designated as "*Schlüssel*" [key] and "*Schloß*" [lock] on the left-hand side of Fig. 8a are related with each other through the semantic unit 6 designated as "*stecken*" [being inserted]. In the world knowledge already present in the fractal network, on the other hand, a semantic unit 6 designated as "*Schlüssel*" [key] on the right-hand side of Fig. 8a is connected through a relation of the VR/VH type, which is not described more closely, with the semantic unit 6 designated as "*Schloß*" [lock] on the right-hand side of Fig. 8a which represents a particular locking mechanism. Moreover this semantic unit 6 designated as "*Schlüssel*" [key] on the right-hand side of Fig. 8a is, however, not connected with the semantic unit 6 designated as "*Schloß*" [castle] on the extreme right side of Fig. 8a which represents a particular building.

AMENDED DOCUMENTS

When a vicinity analysis of the semantic units 6 designated as "*Schlüssel*" [key] and "*Schloß*" [lock; castle] and of their linking units in the world knowledge is now carried out by the semantic unit 6 designated as "classification Janus", it is found that the semantic input units 6 designated as "*Schloß*" [lock; castle] on the left-hand side in Fig. 8a is classified as a semantic unit "*Schloß*" [lock] which is a particular locking mechanism. As the outcome of the vicinity analysis, frequently also referred to as context, the semantic unit 6 designated as "*stecken*" [being inserted] is correspondingly classified as a special case of the relation 2 between the semantic units 6 designated as "*Schlüssel*" [key] and "*Schloß*" [lock; castle], which is not further defined in the world knowledge present in the fractal network. This clearly reveals the advantages of the semantic unit 6 designated as "classification Janus". Not only can the semantic unit 6 designated as "*Schloß*" [lock; castle] on the left side in Fig. 8a be classified correctly, but it can also be learned that "being inserted" is a possible relation between the semantic units 6 designated as "*Schlüssel*" [key] and "*Schloß*" [lock], as is shown by the dashed lines in Fig. 8b that represents the result situation. This figure moreover reveals that the new knowledge acquired by learning may thus also be incorporated into the knowledge present in the fractal network.

In summary, it can be said that semantic units and/or parts of the fractal network are classifiable. This classification is performed in such a manner that the one measure is determined which indicates how well the respective semantic units or the partial fractal network, respectively, fit in the current location, and/or the one location is determined in which the respective semantic units or the partial fractal network, respectively, fit

AMENDED DOCUMENTS

particularly well. Preferably the semantic units contain a marking which indicates whether it is a new input unit or an already existing semantic unit, with input units optionally being present as a partial fractal network and/or optionally not yet being connected with the fractal network through linking units. Incorporation of a new semantic unit or of a new partial network into the fractal network is carried out while taking into account the classification. These new semantic units can be linked with a start-Janus unit. Moreover there is also the possibility of imposing restrictions on the semantic units and/or linking units with a view to those kinds of units they can be linked with. Although this was not mentioned above, one or several input/output devices may equally be provided, whereby the fractal network or part of it may be input or output.

The following is a description of a fourth [fifth] embodiment of the present invention.

It is a frequent case that an instance of a semantic unit is to be generated which is a special case of that semantic unit. In this case, it is possible to refer to the semantic unit as a parent and to the specific instance as a child. Herein a generated child is to inherit part of its parent's vicinity. A fractal network handling this case is shown in Figures 9a to 9c. Here it is useful if a semantic Janus unit 6 referred to as "inheritance Janus" in Figures 9a to 9c and connected with the parent carries out the generation and inheritance processes. In accordance with the representation in Fig. 9c, the informational contents of the newly created semantic units may be overwritten with informational contents originating from input data or other sources.

AMENDED DOCUMENTS

More precisely, the semantic unit 6 shown in Figures 9a to 9c and designated as "inheritance Janus" applies, for example, the following process.

5 The "inheritance Janus" selects a vicinity around the parent to which it is connected. A vicinity may be defined in various ways and manners, e.g., in that it is only allowed to proceed by way of linking units of the VA/VS type(+), "is described by", and "has Janus/function of", and that only immediate neighbors may be selected. In the specific application, the vicinity of the "person" is defined in that it is only allowed to proceed by way of linking units of the type "is described by", i.e. that "eye color" is located in the selected vicinity of the
10 "person", however "living being" is not located in the selected vicinity of the "person" (see Fig. 9a). Here it is to be noted, however, that other vicinities suited for the respective application may also be defined.

20 Subsequently a semantic unit "child" ("new person" in Fig. 9b) is generated which is a particular instance of the semantic unit "parent" ("person" in Fig. 9b). The "child" is linked with the "parent" through a linking 3 of the VR/VS(+) type. After this, children are also
25 generated for all semantic units from the selected vicinity. These children are also linked with their respective parents through linkings of the VR/VS(+) type. In the embodiment, the child "eye color of the new person" is thus created and linked with the semantic unit
30 "eye color" (see Fig. 9b). All children are finally linked among each other in accordance with their respective parents' linking. In the embodiment, the children "new person" and "eye color of the new person" are thus linked with each other by linking unit 2b (see
35 Fig. 9b).

AMENDED DOCUMENTS

In conclusion, the informational contents of the children may be overwritten with informational contents from input objects or other sources. In the exemplary application, the child "new person" is overwritten with
5 "Mr. Otto Maier", and the child "eye color of the new person" with "green" (see Fig. 9c).

In general it may be said that the invention explained above in detail by way of illustrating
10 embodiments for example provides particular advantages in distributed computer systems (such as networks, INTRANET, INTERNET etc.), wherein the information objects and linking objects may be distributed over a multiplicity of computer systems (processors) and storage systems. As a
15 result, for example, many users (world-wide) thereby have the possibility of accessing, constructing and using a like n^{th} -order fractal network. Typical applications herefor are (multimedia) document management systems, geographical information systems with heterogeneous
20 structured data and meta-data, i.e., data describing contents and structure of data blocks, as well as project management systems for structuring and monitoring business processes.

Moreover the above described fractal network according to the invention is suited not only for treating, e.g., speech data, image data or network structures, but also for handling so-called chaotic systems describing, e.g., technical, cultural, economic
30 or ecological contexts. The complex structures may moreover be both static and dynamic, wherein analyzing and/or treating the complex structures may in particular encompass describing, searching, altering and/or simulating.

35

As regards further features and advantages of the present invention, reference is specifically made to the disclosure of the drawing.

AMENDED DOCUMENTS

Claims

1. A fractal network for handling complex structures,
5 wherein the fractal network is comprised of a
multiplicity of units, wherein [characterized in
that] said fractal network contains

semantic units (6) each possessing informational
10 contents, as well as

linking units (1 to 5) describing a relational
content which links two respective semantic units (6)
in such a way that the mutual relation of the two
15 linked semantic units (6) is determined by the
relational content,

characterized in that

20 the network additionally contains specific semantic
Janus units which are capable of carrying out
specific operations on further semantic units
(6).[from former claim 21]

25 [22.] 2. A fractal network according to claim 1 [21],
characterized in that each Janus unit is linked with
one or several further semantic units (6) through one
or several linking units (1 to 5), with the
30 functionality of the Janus unit being restricted so
as to be only capable of performing the specific
operations on those semantic units (6) located in a
predetermined vicinity range of this one or these
several linked semantic units (6).

35

AMENDED DOCUMENTS

[23.] 3. A fractal network according to claim 1 [21],
characterized in that a Janus unit is optionally
linked with one or several further Janus units
through one or several linking units (1 to 5).

5

[24.] 4. A fractal network according to any one of
claims 1 to 3 [21 to 23], characterized in that a
Janus unit is capable of carrying out one or several
of the following operations: creating new semantic
units (6); bundling already existing semantic units
(6) into a single semantic unit (6) possibly to be
newly created; altering and/or deleting already
existing semantic units (6); comparing existing
semantic units (6); recording and altering the values
of attributes; executing an algorithm and/or
calculating a function; recording and/or altering
algorithms; recording a Janus or a part of a Janus.

10
15
20

[2.] 5. A fractal network according to any one of
claims 1 to 4, [claim 1] characterized in that the
linking units (1 to 5) are a particular form of
semantic units (6) which may possess informational
contents and relational contents.

25

[3.] 6. A fractal network according to any one of
claims 1 to 5, [claims 1 or 2] characterized in that
the informational content described by a semantic
unit (6) represents a characterization and/or an
enumeration of those linking units (1 to 5)
connecting this semantic unit (6) with further
semantic units.

30
35

AMENDED DOCUMENTS

[4.] 7. A fractal network according to claim 6, [3]
characterized in that the characterization described
by the informational content is a name and/or a
serial number.

5

[5.] 8. A fractal network according to claim 6, [1 to
7] *characterized in that* the enumeration described by
the informational content is present in a structured
form.

10

[6.] 9. A fractal network according to any one of
claims 1 to 8, [8] *characterized in that* besides the
informational content, the relational content
described by a linking unit (1 to 5) additionally
contains a linking characterization describing the
respective characterization(s) of the semantic units
(6) linked by them, one or two indications of
direction in relation to these linked semantic units
(6), and/or weightings G of the one or two
indications of direction.

15

20

[7.] 10. A fractal network according to any one of
claims 1 to 9, [1 to 6] *characterized in that*
moreover one or several linking units (1 to 5) may in
turn be linked with one or several semantic units (6)
through one or several respective linking units (1 to
5), and/or one or several linking units (1 to 5) in
turn may be linked with one or several linking units
(1 to 5) through one or several linking units (1 to
5).

30

35

AMENDED DOCUMENTS

- 5 [8.] 11. A fractal network according to any one of
claims 1 to 10, [1 to 7] *characterized in that* the
relational content of a linking unit (1 to 5)
optionally contains information about the respective
type of linking of the interrelated semantic units
(6).
- 10 [9.] 12. A fractal network according to claim 11, [8]
characterized in that the type of linking described
by a linking unit (1 to 5) optionally moreover
contains information about a relation VR, i.e., about
a comparison of the respective linked units, and/or
15 about an exchange relation VA, i.e., about a uni- or
bilateral interaction of the linked units.
- [10.] 13. A fractal network according to claim 11 or 12,
[8 or 9] *characterized in that* the type of linking
20 described by a linking unit additionally contains
information about whether a scale change VS takes
place in the type of linking or whether no scale
change VH takes place.
- 25 [11.] 14. A fractal network according to any one of
claims 11 to 13, [8 to 10] *characterized in that* the
relational content of a linking unit (1 to 5)
contains information about the respective type of
30 linking, consisting of the pairs VS/VR, VS/VA, VH/VR
or VH/VA.
- 35 [12.] 15. A fractal network according to claim 13 or 14,
[10 or 11] *characterized in that* the scaling
information VS has the function of describing the

AMENDED DOCUMENTS

type of relation with a larger, i.e., superordinate, or with a smaller, i.e., subordinate semantic unit (6).

5

[13.] 16. A fractal network according to claim 13 or 14,
[10 or 11] *characterized in that* the scaling
information VS has the function of describing the
type of relation with a more general or more specific
semantic unit (6).

10

[14.] 17. A fractal network according to any one of
claims 1 to 16, [1 to 13] *characterized by* a distance
function indicating the semantic distance between two
respective semantic units (6).

15

[15.] 18. A fractal network according to claim 17, [6 and
14] *characterized in that* the distance function is
determined through a suitable mathematical function
of a variable parameter G which may be present in
several linking units (1 to 5) and expresses the
strength of the mutual linking.

20

25

[16.] 19. A fractal network according to any one of
claims 1 to 18, [1 to 15] *characterized in that* the
informational contents of the semantic units and/or
linking units, besides or instead of optionally
static data, also contain algorithms and/or functions
and/or mathematical formulae.

30

[17.] 20. A fractal network according to any one of
claims 1 to 19, [1 to 16] *characterized in that* the

35

AMENDED DOCUMENTS

informational contents of at least some of the semantic units (6) constitute attributes more closely describing further semantic units (6) or linking units (1 to 5).

5

[18.] 21. A fractal network according to claim 20 [17] characterized in that the network furthermore contains specific linking units (1 to 5) having the function of establishing the linking of semantic units (6) constituting attributes with those semantic units (6) and/or linking units (1 to 5) to which these attributes are associated.

15

[19.] 22. A fractal network according to claim 20 or 21, [17 or 18] characterized in that the attributes optionally contain values which are elements from a set, a range, a list or another ordered or inordinate structure.

20

[20.] 23. A fractal network according to claim 22, [19] characterized in that the ordered or inordinate structure constituting the respective attribute is formed by figures, calendar data, audio data, video data, text data, tables, image data, geometry data, fuzzy-logic sets or bundled data or a combination of these.

30

[25.] 24. A fractal network according to any one of claims 1 to 23, [1 to 24] characterized in that semantic units (6) and/or parts of the fractal network can be classified.

35

AMENDED DOCUMENTS

- 5 [26.] 25. A fractal network according to claim 24, [25]
characterized in that classification is carried out
by determining the one master dimension that
indicates how well the respective semantic units (6)
or the partial fractal network, respectively, fit in
a given location, and/or by determining those
locations in the fractal network in which the
respective semantic units (6) or the partial fractal
10 network, respectively, fit particularly well, wherein
it is possible to jointly indicate the respective
master dimensions.
- 15 [27.] 26. A fractal network according to [any one of]
claim[s] [1 to 26] 25, characterized in that the
semantic units (6) contain a marking which indicates
whether it is a matter of a new input unit or of an
already existing unit, with input units optionally
20 being present as partial fractal networks and/or
optionally not yet being connected with the network
through linking units (1 to 5).
- 25 [28.] 27. A fractal network according to claim 26 [and
27], characterized in that incorporation of a new
unit or of a new partial network, respectively, into
the fractal network is carried out by taking into
consideration the classification.
- 30 [29.] 28. A fractal network according to claim 26 or 27,
[27 or 28] characterized in that new semantic units
(6) can be linked with a start-Janus unit.
- 35

AMENDED DOCUMENTS

5 [30.] 29. A fractal network according to any one of
claims 1 to 28 [29], *characterized in that*
restrictions can be imposed on the semantic units (6)
and/or linking units (1 to 5) regarding those kinds
of units with which they may be linked.

10 [31.] 30. A fractal network according to any one of
claims 1 to 29 [30], *characterized by one or several*
input/output devices for inputting and outputting,
respectively, the fractal network or part thereof.

Fig. 1a

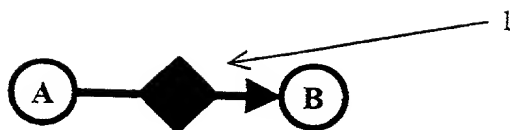


Fig. 1b

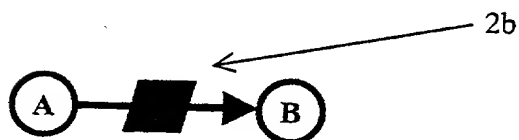
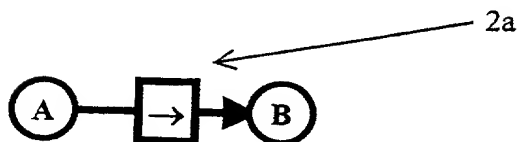
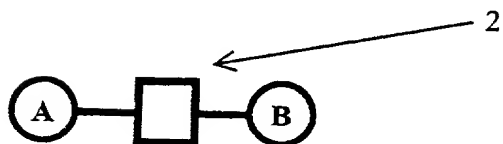


Fig. 1c

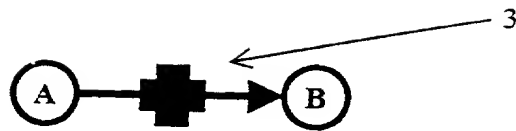


Fig. 1d

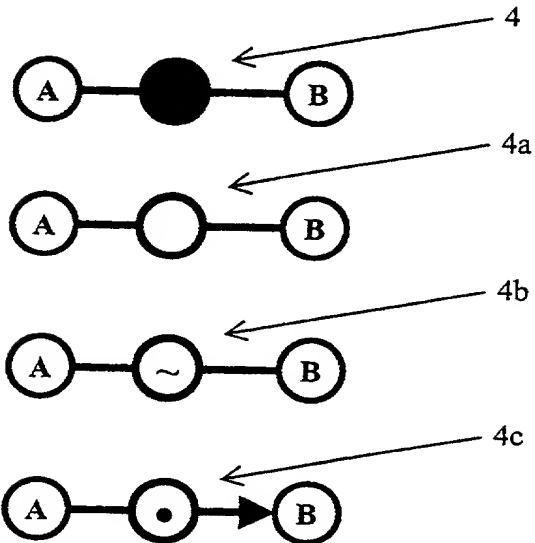


Fig. 1e

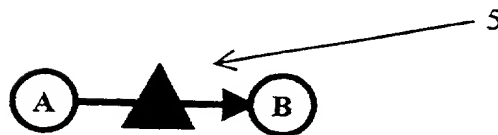


Fig. 2

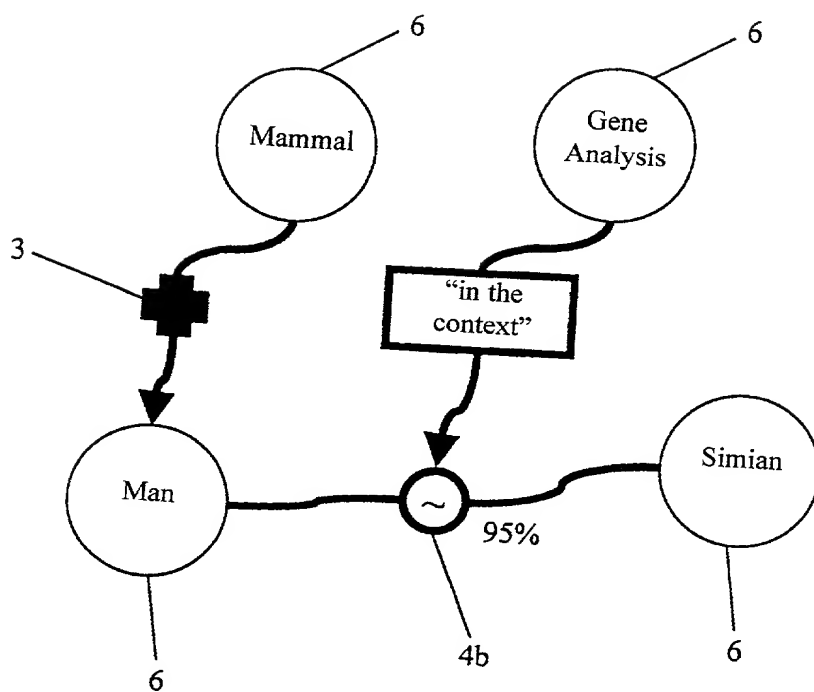


Fig. 3

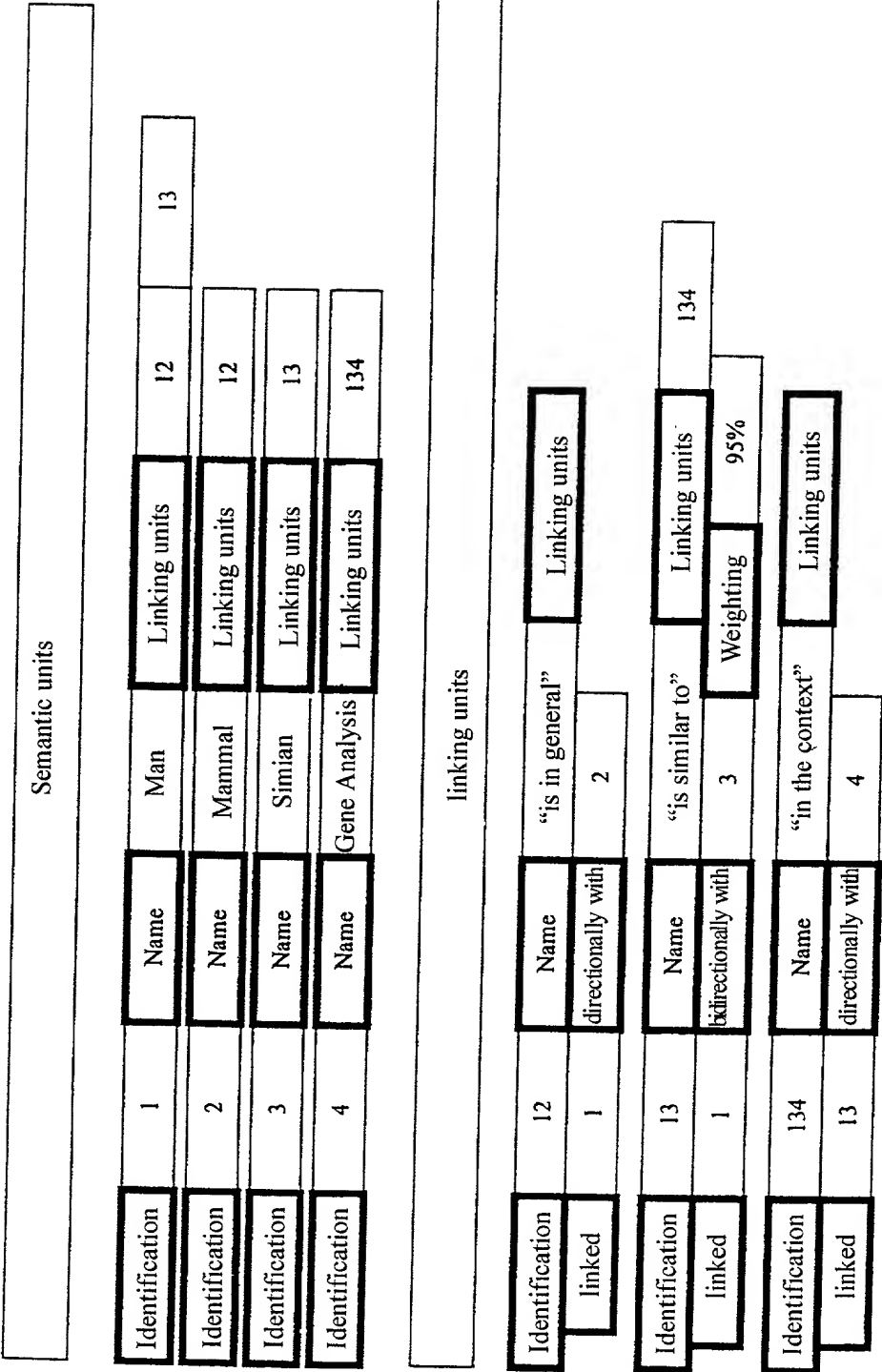


Fig. 4a

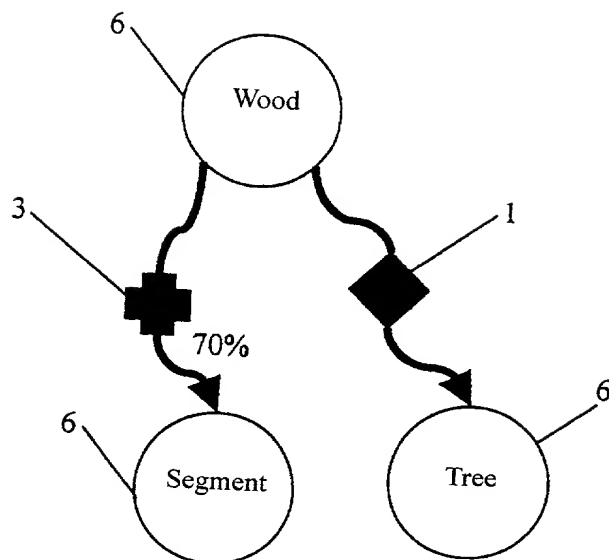


Fig. 4b

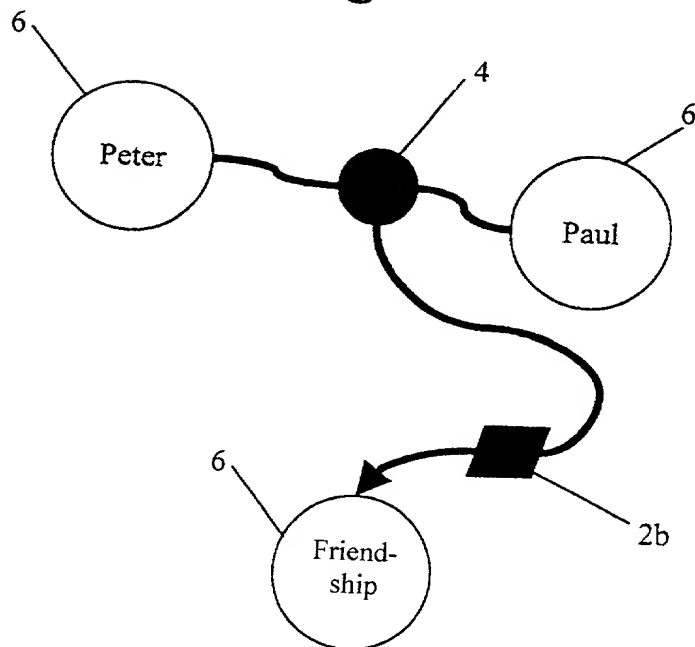


Fig. 5

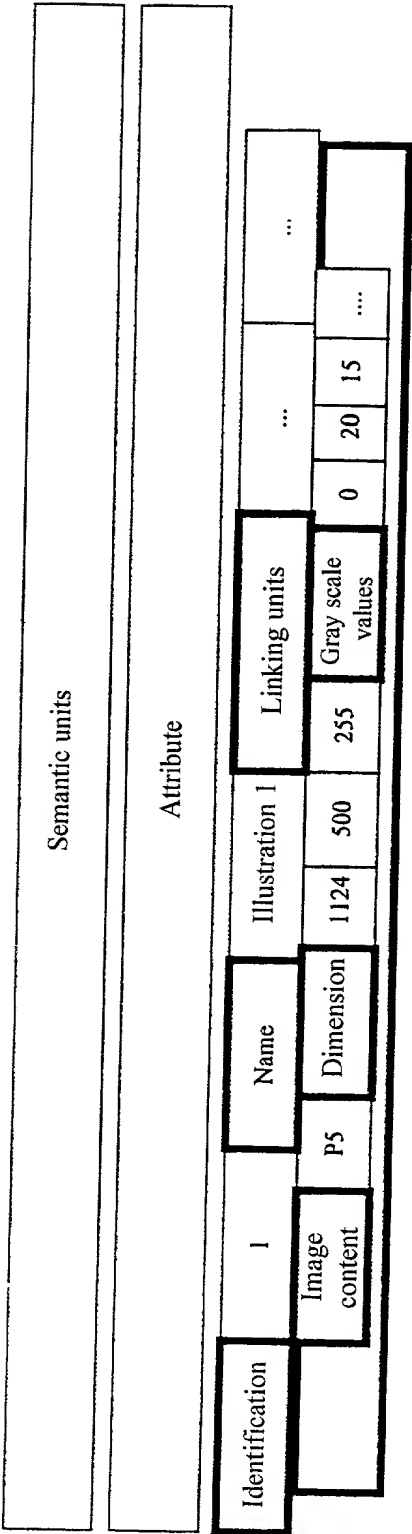
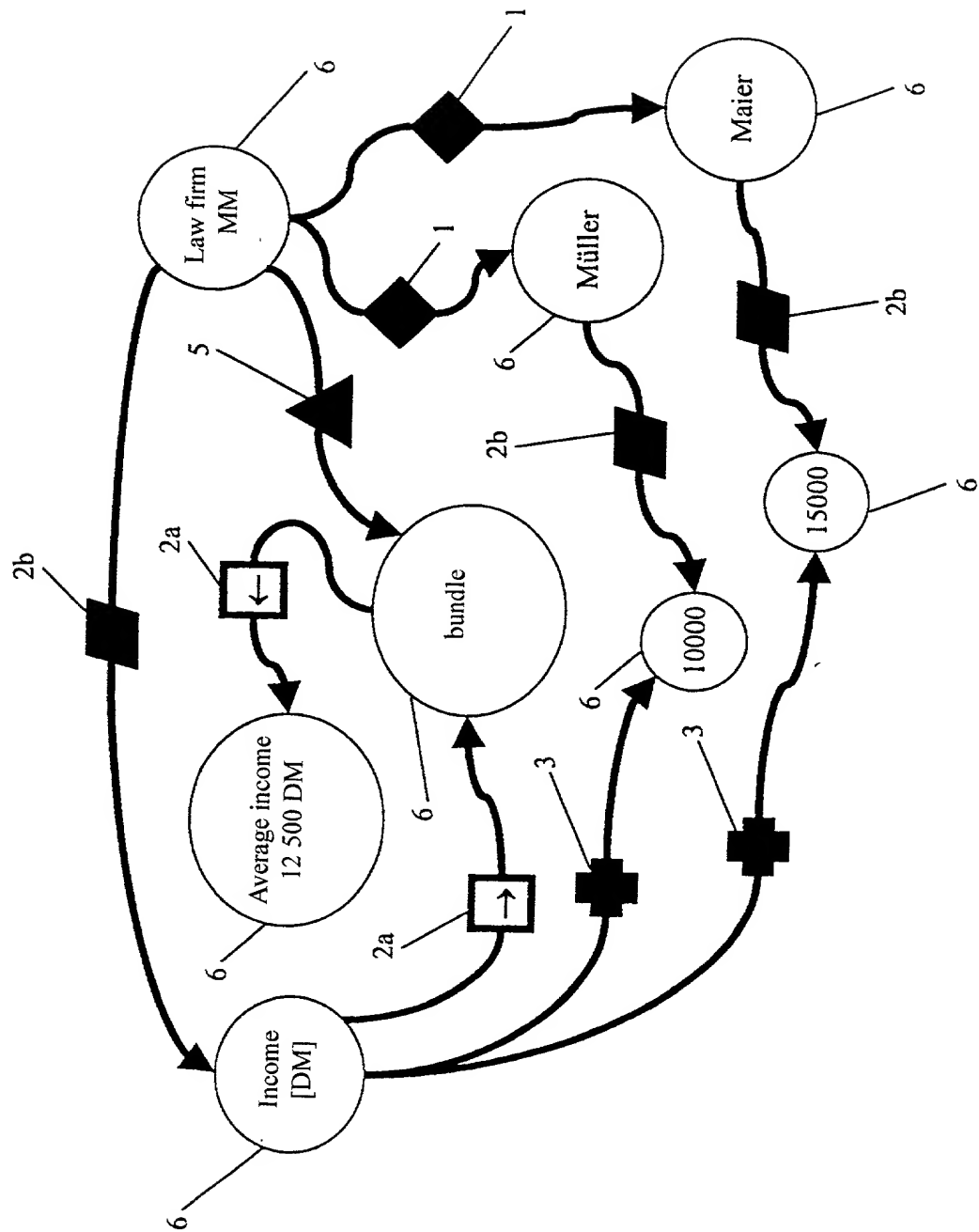


Fig. 6



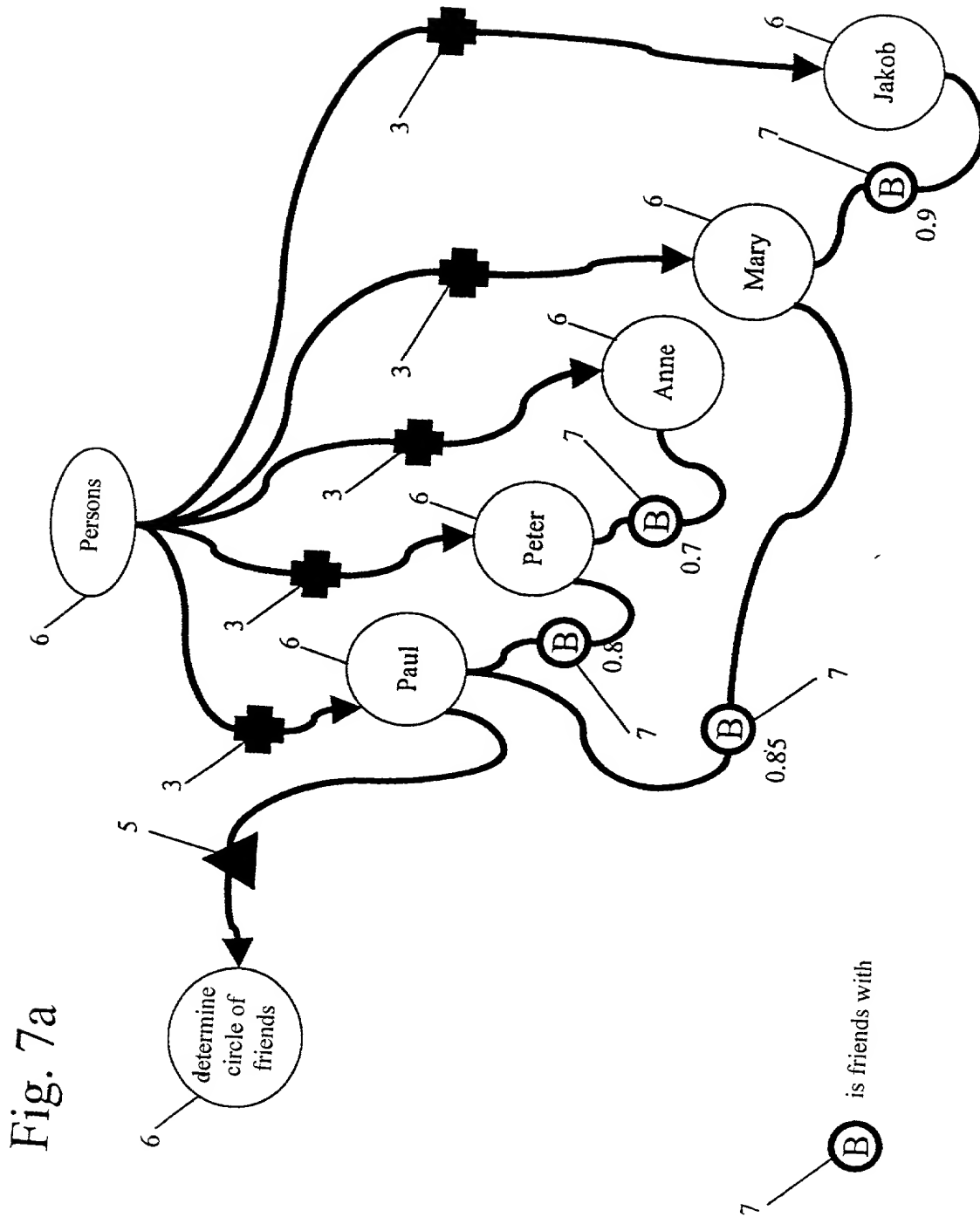
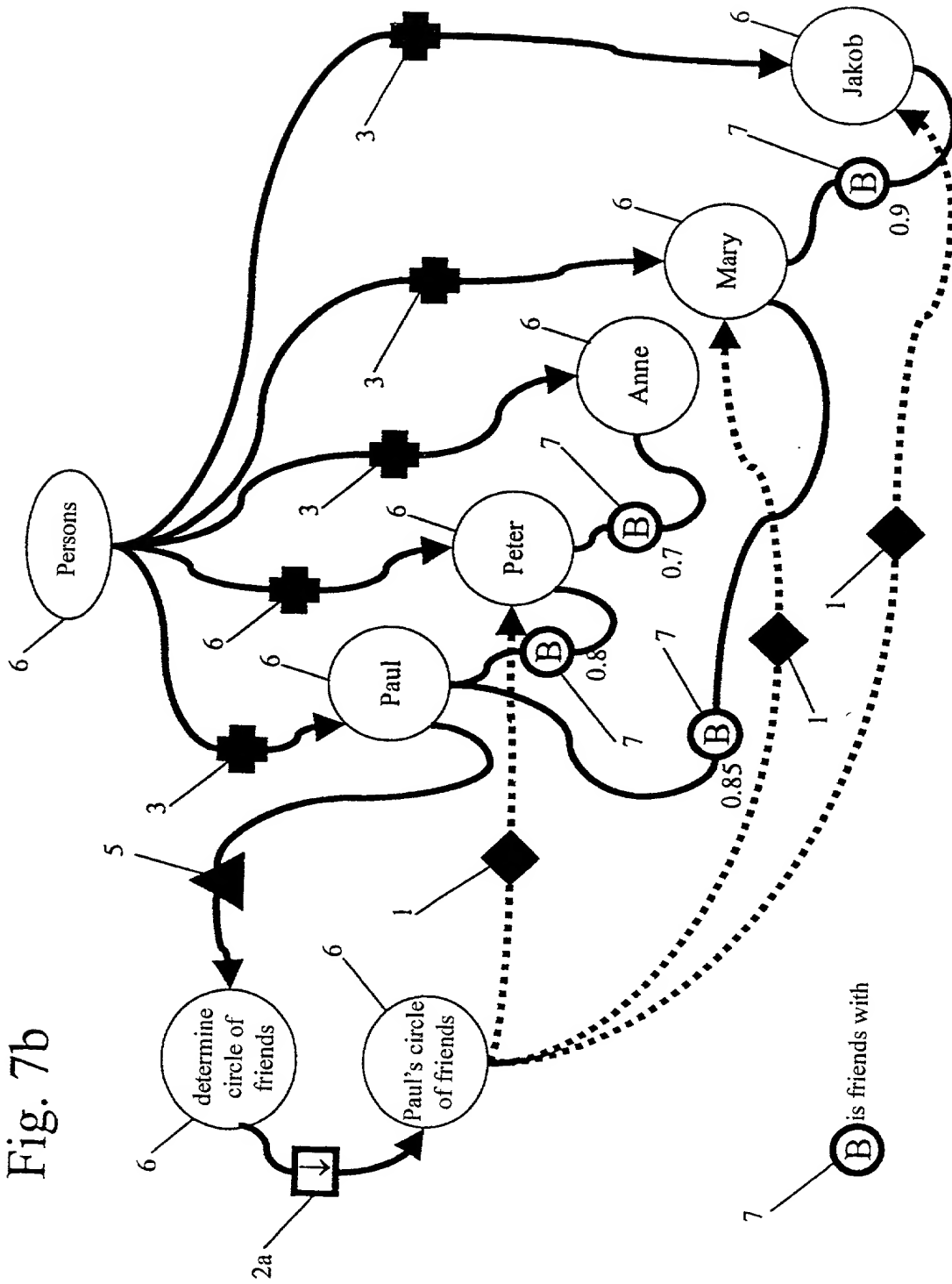


Fig. 7b



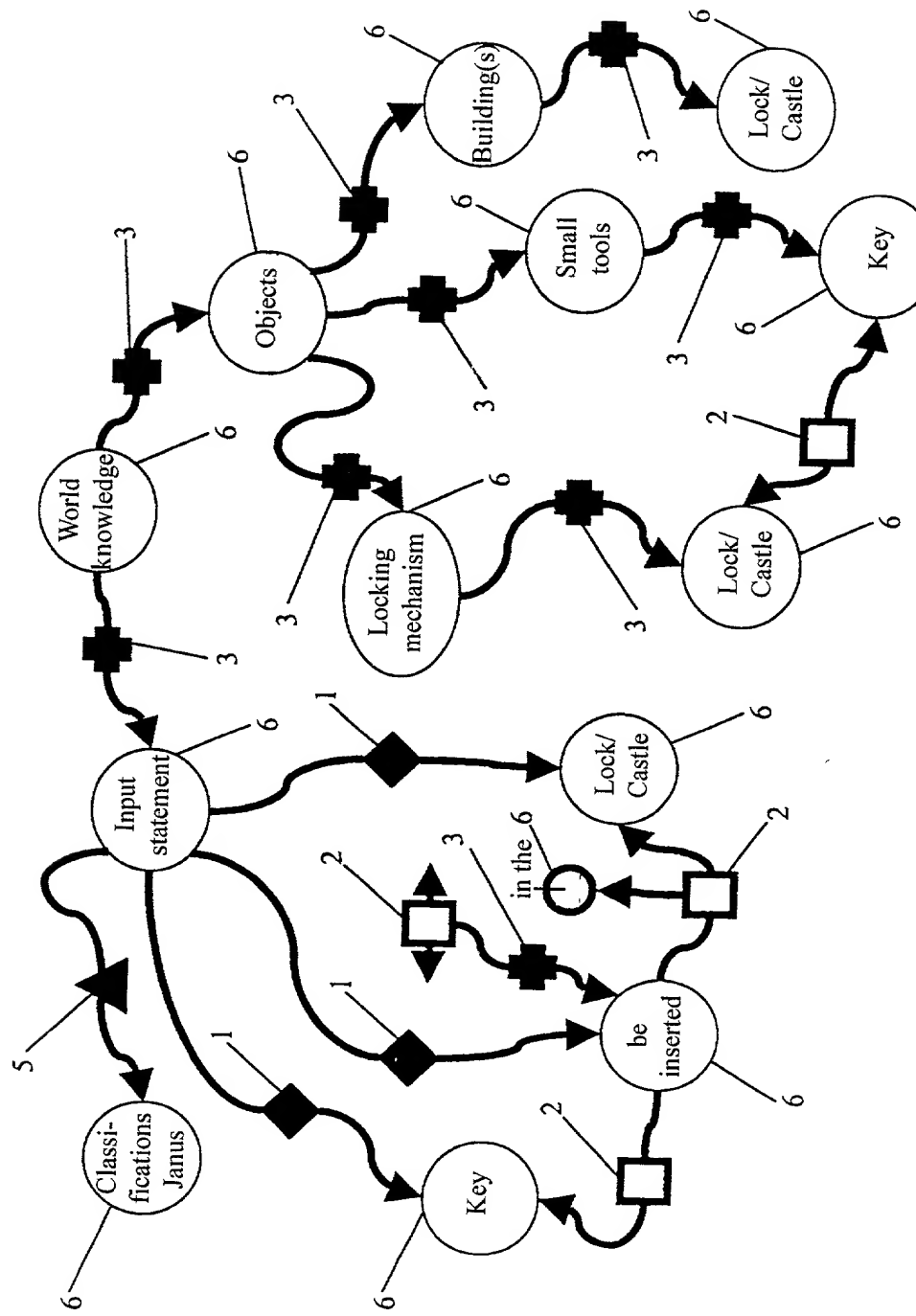


Fig. 8a

Fig. 8b

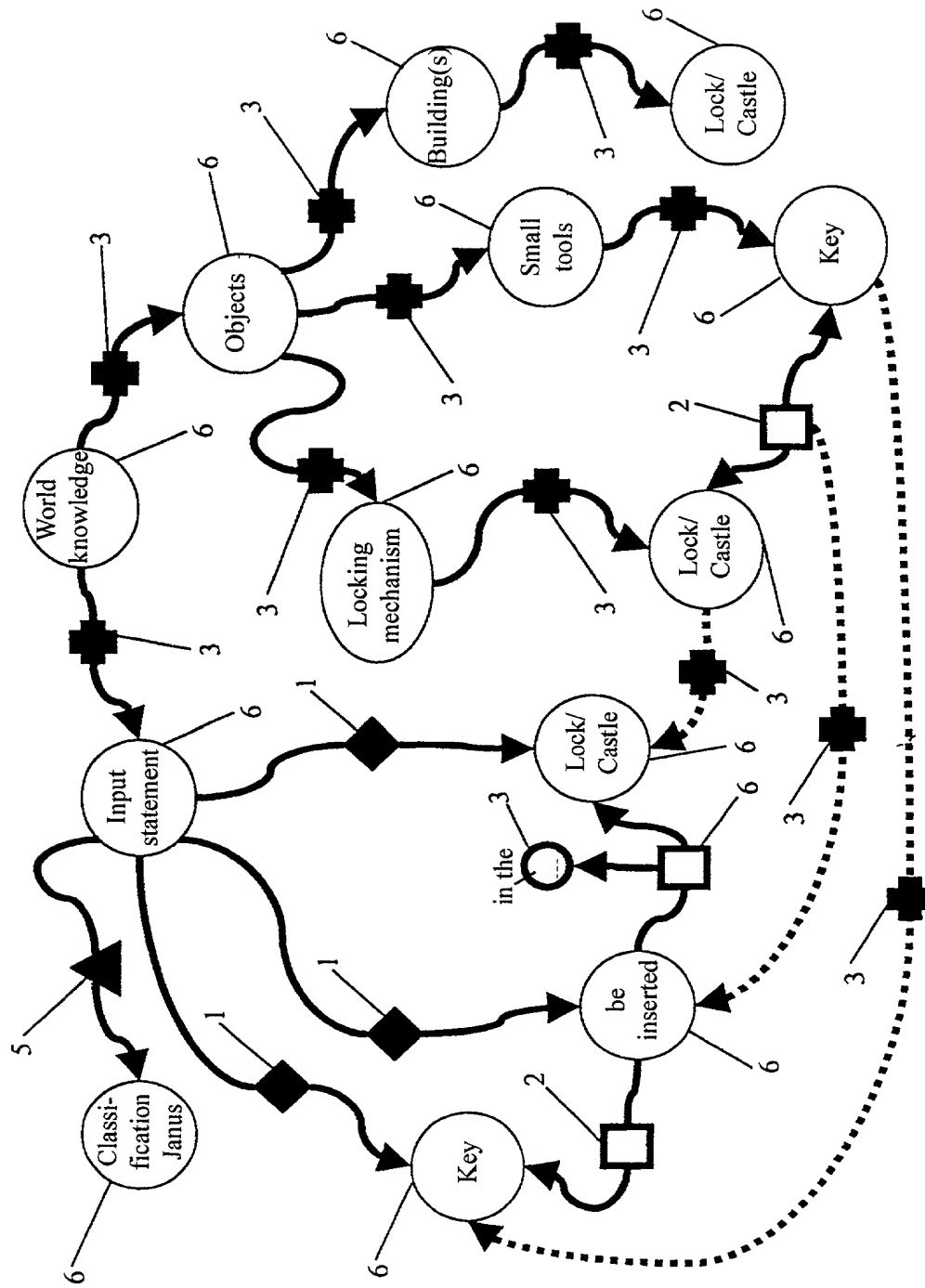


Fig. 9a

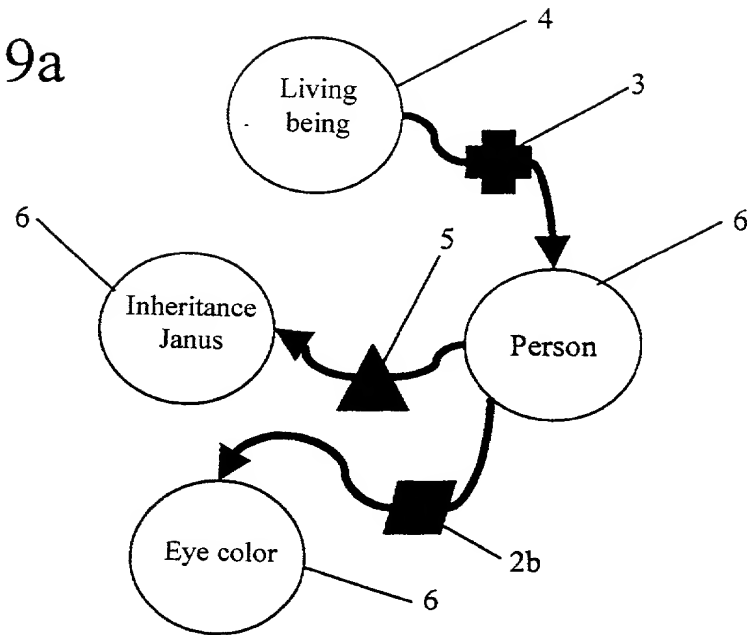


Fig. 9b

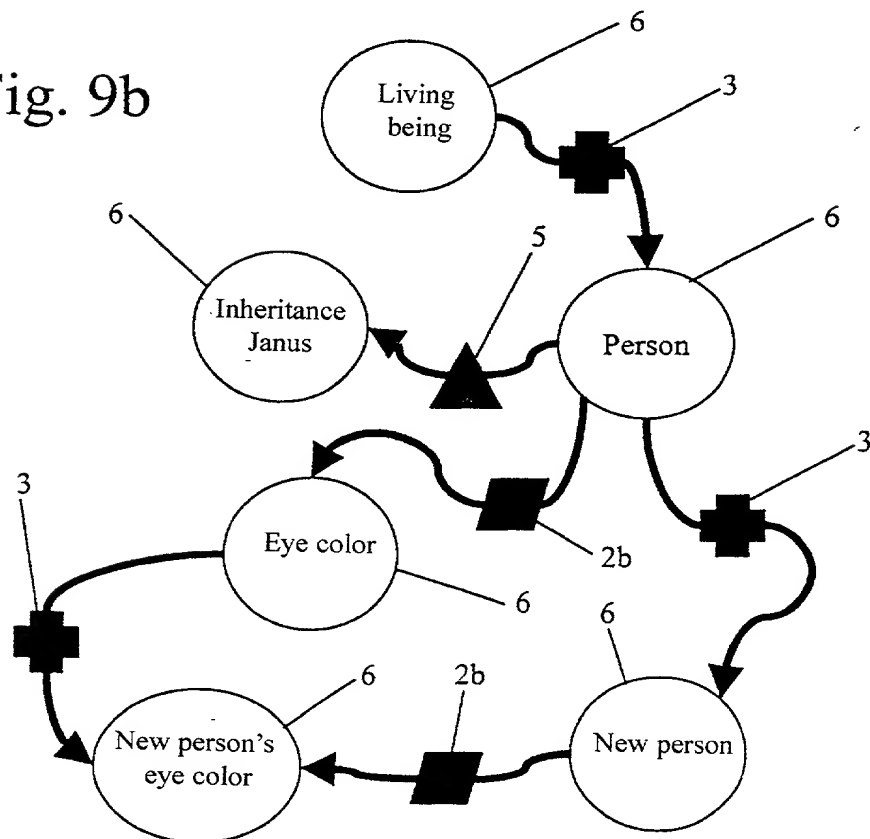
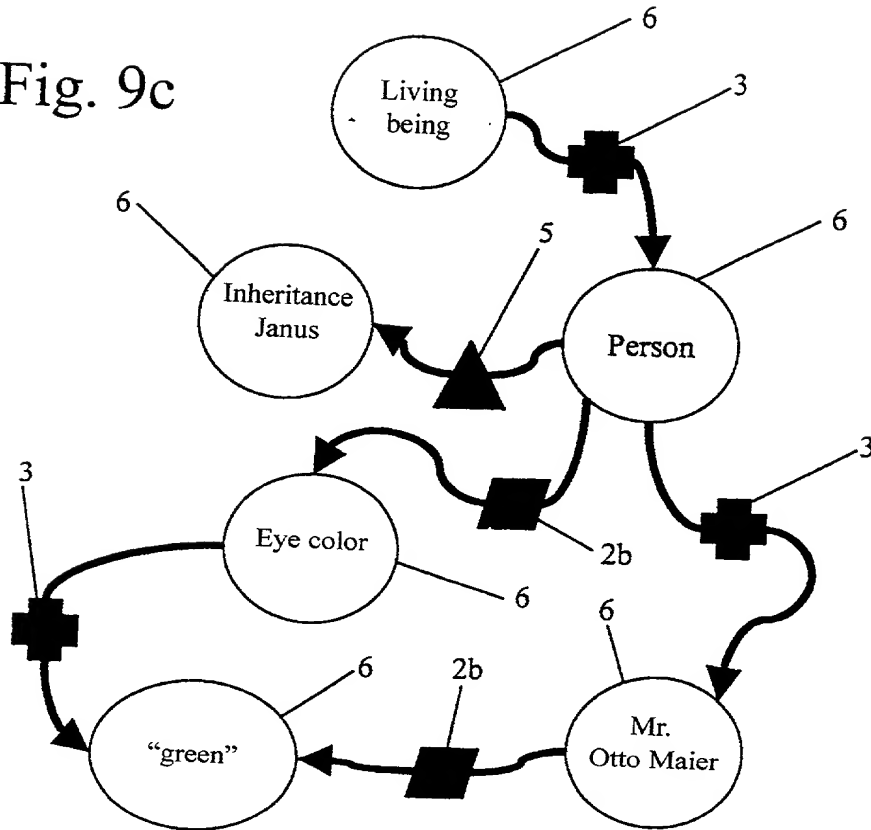
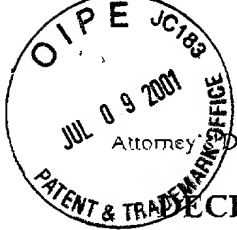


Fig. 9c





Attorney Docket No. 03400P008

264090

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or any original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

NTH ORDER FRACTAL NETWORK FOR HANDLING COMPLEX STRUCTURES

the specification of which



is attached hereto.

was filed on September 24, 1999 as

United States Application Number

or PCT International Application Number PCT/EP99/07137

and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

APPLICATION NUMBER	COUNTRY (OR INDICATE IF PCT)	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
DE 198 45 555.0	Germany	02/10/1998	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes
DE 199 08 204.9	Germany	25/02/1999	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes
			<input type="checkbox"/> No <input type="checkbox"/> Yes

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Docket No. 003400.P008

Pg 1

JUL 04 10 05:06AM
N. 3315 S. 4/6

WINTER BRANDL ET AL 08161 930100

2001 12:54

+49 89 23118090

APPLICATION NUMBER	FILING DATE	STATUS (ISSUED, PENDING, ABANDONED)

I hereby appoint BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP, a firm including: William E. Alford, Reg. No. 37,764; Farzad E. Amini, Reg. No. 42,261; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Lisa N. Benado, Reg. No. 39,295; Bradley J. Berezna, Reg. No. 33,474; Michael A. Bernadecou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; R. Alan Burnett, Reg. No. 36,149; Gregory D. Caldwell, Reg. No. 39,926; Andrew C. Chen, Reg. No. 43,544; Thomas M. Coester, Reg. No. 39,637; Donna Jo Coningsby, Reg. No. 41,684; Florin A. Corie, Reg. No. 46,244; Dennis M. deGuzman, Reg. No. 41,702; Stephen M. De Klerk, Reg. No. P46,503; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Justin M. Dillon, Reg. No. 42,486; Sanjeev Dutta, Reg. No. P46,145; Matthew C. Fagan, Reg. No. 37,542; Tarek N. Fahmi, Reg. No. 41,402; George Fountain, Reg. No. 36,374; James Y. Go, Reg. No. 40,621; James A. Henry, Reg. No. 41,064; Willmore F. Holbrow III, Reg. No. 41,845; Sheryl Sue Holloway, Reg. No. 37,850; George W. Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; William W. Kidd, Reg. No. 31,772; Sang Hui Kim, Reg. No. 40,450; Walter T. Kim, Reg. No. 42,731; Eric T. King, Reg. No. 44,188; Steven Laut, Reg. No. 47,736; George Brian Leavell, Reg. No. 45,436; Kurt P. Leyendecker, Reg. No. 42,799; Gordon R. Lindeen III, Reg. No. 33,192; Jan Carol Little, Reg. No. 41,181; Robert G. Litts, Reg. No. 46,876; Julio Loza, Reg. No. P47,758; Joseph Lutz, Reg. No. 43,765; Michael J. Mallie, Reg. No. 36,591; Andre L. Marais, under 37 C.F.R. § 10.9(b); Raul D. Martinez, Reg. No. 46,904; Paul A. Mendonsa, Reg. No. 42,879; Clive D. Menezes, Reg. No. 43,493; Chun M. Ng, Reg. No. 36,878; Thien T. Nguyen, Reg. No. 43,835; Thinh V. Nguyen, Reg. No. 42,034; Dennis A. Nicholls, Reg. No. 42,056; Daniel E. Ovanezian, Reg. No. 41,236; Kenneth B. Paley, Reg. No. 38,989; Gregg A. Pearson, Reg. No. 43,001; Marina Portnova, Reg. No. P45,750; William F. Ryan, Reg. No. 44,313; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Jeffrey S. Schubert, Reg. No. 43,098; George Simion, Reg. No. P47,089; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Edwin H. Taylor, Reg. No. 25,129; Lance A. Torres, Reg. No. 43,184; John F. Travis, Reg. No. 43,203; Joseph A. Tvarowski, Reg. No. 42,191; Mark C. Van Ness, Reg. No. 39,865; Thomas A. Van Zandt, Reg. No. 43,219; Lester J. Vincent, Reg. No. 31,460; Glenn E. Von Tersch, Reg. No. 41,364; John Patrick Ward, Reg. No. 40,216; Mark L. Watson, Reg. No. P46,322; Thomas C. Webster, Reg. No. P46,154; and Norman Zafman, Reg. No. 26,250; my patent attorneys, and Firasat, Ali, Reg. No. 43,715; and Richard A. Nakashima, Reg. No. 42,023; my patent agents, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025; telephone (310) 207-3800, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole/First Inventor (given name, family name)

Günter Schmidt

Inventor's Signature

G. Schmidt

Date

2.7.2007

Residence

D-82008 Unterhaching, Germany
(City, State)

Citizenship

German
(Country)

P. O. Address

Fägerstrasse 11

D-82008 Unterhaching, Germany

Docket No. 003400.P008

Pg. 2

1/5 5 167297 N.P.3297

WINTER BRANDL ET AL 08161 930100

1. JULI 2007 15:35

JUL 04 10:05:06 AM
N.P.3315 5/6

WINTER BRANDL ET AL 08161 930100

2-TLR-2001 17:25 VON: CHRISTOPH BECKER +49 8151 3869

AN: 08923118090

2-00

Full Name of Second/Joint Inventor (if not same, family name) Maria Achberger
 Inventor's Signature [Signature] Date 02.7.2001
 Residence D-80469 München, Germany DEX Citizenship German
 (City, State) (Country)
 P. O. Address Jokstrastraße 7
D-80469 München, Germany

3-00

Full Name of Third/Joint Inventor (if not same, family name) Martin Rost
 Inventor's Signature [Signature] Date 2.7.2001
 Residence D-80795 München, Germany DEX Citizenship German
 (City, State) (Country)
 P. O. Address Neuwallstraße 22 Sackinger Str. 4a
D-80795 München, Germany D-82349 Starnberg

4-00

Full Name of Fourth/Joint Inventor (if not same, family name) Andrei Khuradi
 Inventor's Signature [Signature] Date 3.7.2001
 Residence D-12047 Berlin DEX Citizenship German
 (City, State) (Country)
 P. O. Address Manitiusstr. 16
D-12047 Berlin D-12047 BERLIN

5-00

Full Name of Fifth/Joint Inventor (if not same, family name) Jürgen Klau
 Inventor's Signature [Signature] Date 3.7.2001
 Residence CH-8134 Allmäh DEX Citizenship German
 (City, State) (Country)
 P. O. Address Toblerstr.
CH-8134 Allmäh

Doclet No. 003400.0005

Pr 3

1/2 S. 2/7

WINTER BRANDL ET AL 08161 930100

2 JUL 2001 16:39

00002

THE RESEARCH CH

0017218950

01.01.2001 16:18

17.3815 S. 9/6
 JUL 04 2001 05:06AM

WINTER BRANDL ET AL 08161 930100